5. (Twice Amended) An integrated circuit of claim 1, wherein a conductive material of the liner comprises a random grain orientation or amorphous character.

REMARKS

This communication is to respond to the Office Action dated November 21, 2000. Claims 1-5 and 7-15 are pending. Claims 1-5 have been amended. The Examiner's reconsideration is respectfully requested in view of the above amendment and the following remarks.

In the Office Action, claims 2-5 were rejected under 35 U.S.C §112, second paragraph, as being indefinite. Claims 1-5 and 7-15 were rejected under 35 U.S.C §103(a) as being unpatentable over Sumi et al. (U.S. Patent No. 5,397,744).

As to rejections to claims 2-5 under 35 U.S.C. §112, second paragraph, applicant has amended the claims in a way believed to overcome the rejection. Withdrawal of rejections is respectfully requested.

As to the rejection of claim 1 under 35 U.S.C. §103(a), the Examiner stated that Sumi et al. ("Sumi") taught the elements of claim 1 of the present invention.

The rejection is respectfully traversed.

Amended claim 1 recites, *inter alia*, "a liner layer lining the bottom surface and sidewalls of the damascene structure and encapsulating the conductor by contacting a top surface of the conductor, the liner layer imparts a random grain orientation in the conductive material of the conductor to improve electromigration lifetime of the conductor."

The present invention is directed to an improved device interconnection, wherein the grain orientation randomness can be achieved by encapsulating the conductor with the liner (See

specification, page 8, lines 31-33). Referring to FIG. 1D of the present disclosure, a liner layer first encapsulates the conductor by contacting the bottom and sidewalls of the conductor (See specification, page 8, line 33 to page 9, line 5, and FIG. 1D). Referring to FIG. 1E of the present disclosure, the liner layer further provides a planar surface to contact the top surface of the conductor to complete the encapsulation (See specification, page 9, lines 9-11). In addition, conductors in different damascene structures, such as a dual damascene structure, can also be encapsulated by using the present invention as shown in FIGs. 2E and 2F. Advantageously, by encapsulating the conductor in damascene structure with a liner that causes the conductor material to have a random grain orientation, improved electromigration reliability is achieved (See specification, page 12, line 30 to page 13, line 2).

Sumi is directed to an aluminum metallization method, however, Sumi addresses a different problem than the present invention. As the Examiner is probably aware, electromigration is a mass transport mechanism which is dependent on current flow. This is different from diffusion which is dependent on mass concentration, time and temperature. Although both processes are related to mass transport, there is no disclosure or suggestion in Sumi of electromigration or the grain structure of the conductor deposited on the liner. In fact, there is no motivation in Sumi to encapsulate a conductor on the top surface since diffusion between conductors is not a problem. The encapsulation of conductors is useful for solving electromigration problems which can occur during operation of the device.

Nowhere in Sumi is grain orientation randomness achieved by encapsulating the conductor with the liner, as claimed by the present invention. Nor is a liner layer which further provides a planar surface to contact the top surface of the conductor to complete the encapsulation disclosed or suggested, as claimed by the present invention. Thus, an ordinary

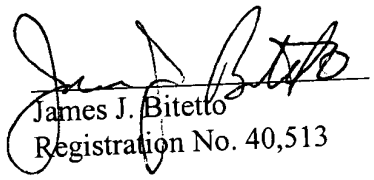
person skilled in the art would reasonably understand that Sumi does not teach or suggest "a liner layer lining the bottom surface and sidewalls of the damascene structure and encapsulating the conductor by contacting a top surface of the conductor, the liner layer imparts a random grain orientation in the conductive material of the conductor to improve electromigration lifetime of the conductor."

Therefore, claim 1 is not rendered obvious by Sumi for at least the reasons stated. The Examiner's reconsideration of the rejection is respectfully requested.

Claims 2-5, 7-15 and added claim 28 directly or indirectly depend from claim 1. Therefore, claims 2-5, 7-15 and 28 are believed to be allowable for at least the reasons stated. The Examiner's reconsideration of the rejection is respectfully requested.

In view of the foregoing amendments and remarks, it is respectfully submitted that all the claims now pending in the application are in condition for allowance. Early and favorable reconsideration of the case is respectfully requested.

Respectfully submitted,

By: 

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